

Work Order ID 143638

143638

Page 1

Thursday, March 17, 2016 1:46:14 PM

Item ID: D350-748-143TRN Accept ***N900040100*** Setup Start ***NS1***
 Revision ID: Stop ***NS2***
 Item Name: SS Crosstube Turning Detail
 Start Date: 3/17/2016 Start Qty: 1.00 ***1*** Cust Item ID:
 Required Date: 3/28/2016 Req'd Qty: 1.00 ***1*** Customer:
 Reference:

Approvals: Process Plan: MCS Date: MAR 17 2016 Tooling: Date: Run Start ***NR1***
 QC: Date: SPC (Y/N): Date: Stop ***NR2***

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
Draw Nbr	Revision Nbr								
D350-748-143	A								

100 0.00
100 MORI SEIKI CNC LATHE LARGE
 Mori Seiki Memo 0.02
 Mori Seiki CNC Lathe Large
 1-Fill tube with sand & install plugs on both ends as per Folio _____
 2-Turn first side as per Folio _____
 3- File transition lines smooth.
 FOLIO REV: N/A
 DWG REV: A

110 0.00
110 QC2- Inspect parts off machine FAI/FAIB
 QC Memo 0.00
 Quality Control

C Φ
mm
16/03/18
C Φ
mm
16/03/21

DQA: _____ Date: _____



WORK ORDER NON-CONFORMANCE / UPDATE

QA Closed: _____ Date: _____

Work Order update only ☐

Work Order: _____ Part No. _____ NCR No. _____		DISPOSITION Rework ☐ Scrap ☐ Use-as-is ☐ Suspected Unapproved ☐		AGAINST DEPARTMENT/PROCESS Skid-tube ☐ Machining ☐ Thermoforming ☐ Large Fab ☐ Cross tube ☐ Small Fab ☐ Finishing ☐ Composite ☐ Water Jet ☐ Prod. Eng. Coord. ☐ Rec/Store/Packaging ☐ Supplier ☐ Engineering ☐ Quality ☐ Other ☐							
Date :		Step #:		QTY Effective :			MRB (QSI042) Approval				
Description Work Order Deviation				Disposition				Completed By Lead hand / Supervisor Approval Verification QC / QA Coordinator Approval			
Root Cause		FAULT CATEGORY									
Environment	☐	No Re-verification	☐	Pressure/Forced	☐	Temperature/Cure	☐	Power Loss/Surge	☐	Positioned Wrong	☐
Design	☐	Operator	☐	Bending	☐	Set-up	☐	Folio/Program	☐	Outside Dimensions	☐
Doc/Data	☐	Offset/Setup	☐	Centre Not Concentric	☐	BOM/Route	☐	Grain	☐	Over/Under tolerance	☐
Equip/Tooling	☐	Supplier	☐	Cracks	☐	Broken/Damage/Defect	☐	Weld	☐	Part Incorrect	☐
Handling/Pre	☐	Training	☐	Crimp/Kink/Ripple/Wave	☐	Inspection Incomplete/Unqualified	☐	Wrong Stock Pulled	☐	Part Lost/Missing	☐
Material	☐	Use for Testing	☐	Cuffs	☐	Contamination	☐	Out of Sequence	☐	Part Moved	☐
Internal Transport	☐	Poor Information	☐	Crushing	☐	Countersink	☐	Off-set	☐	Drawing	☐
Tribal Knowledge	☐	Rushing	☐	Heat Treat	☐	Cut Too Short	☐	Mislabeled	☐	Finish	☐
LOA	☐	Product Improvement	☐	Wave/Twist in Tube	☐	Instructions Incomplete/Unclear	☐	Fit/Function	☐	Misread	☐
Substation	☐	Process Improvement	☐	Marks/Chatter	☐	Drill Holes	☐	Misaligned/off center	☐	Turning Sequence	☐
Past Expiry Date	☐	Manufacturing Process	☐	OTHER :							
Misidentified	☐	Past Due	☐								

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Item ID: D350-748-143TRN

Accept

N900040100

Setup Start ***NS1***

Revision ID:

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Start Date: 3/17/2016 Start Qty: 1.00 ***1***

Cust Item ID:

Required Date: 3/28/2016 Req'd Qty: 1.00 ***1***

Customer:

Reference:

Approvals: Process Plan: _____ Date: _____ Tooling: _____ Date: _____

Run Start ***NR1***

QC: _____ Date: _____ SPC (Y/N): _____ Date: _____

Stop ***NR2***

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
--------------------------------	--------------------------	----------------------	---------	--------	--------------	---------------	---------------	------------------	----------------

120

0.00

120

Mori Seiki

MORI SEIKI CNC LATHE LARGE

Memo

0.04

Mori Seiki CNC Lathe Large

1-Turn second side as per Folio _____
2- File transition lines smooth.
3-Scribe Part & Batch as per Dwg D350-748-143
FOLIO REV: N/A
DWG REV: B

1 ϕ mm
16/03/22

130

QC2- Inspect parts off machine FAI/FAIB

0.00

130

QC

Memo

0.00

Quality Control

1 ϕ mm
16/03/22

140

QC8- Inspect parts - second check

0.00

140

QC

Memo

0.00

Quality Control

1 ϕ DAS
47
9-89
16-03-28

DQA: _____ Date: _____



WORK ORDER NON-CONFORMANCE / UPDATE

QA Closed: _____ Date: _____

Work Order update only ☐

Work Order: _____ Part No. _____ NCR No. _____	DISPOSITION Rework ☐ Scrap ☐ Use-as-is ☐ Suspected Unapproved ☐	AGAINST DEPARTMENT/PROCESS Skid-tube ☐ Machining ☐ Thermoforming ☐ Large Fab ☐ Cross tube ☐ Small Fab ☐ Finishing ☐ Composite ☐ Water Jet ☐ Prod. Eng. Coord. ☐ Rec/Store/Packaging ☐ Supplier ☐ Engineering ☐ Quality ☐ Other ☐			
Date :	Step #:	QTY Effective :		MRB (QSI042) Approval	
Description Work Order Deviation		Disposition			
				Completed By	
				Lead hand / Supervisor Approval Verification	
				QC / QA Coordinator Approval	
Root Cause Environment ☐ Design ☐ Doc/Data ☐ Equip/Tooling ☐ Handling/Pre ☐ Material ☐ Internal Transport ☐ Tribal Knowledge ☐ LOA ☐ Substation ☐ Past Expiry Date ☐ Misidentified ☐ No Re-verification ☐ Operator ☐ Offset/Setup ☐ Supplier ☐ Training ☐ Use for Testing ☐ Poor Information ☐ Rushing ☐ Product Improvement ☐ Process Improvement ☐ Manufacturing Process ☐ Past Due ☐		FAULT CATEGORY Pressure/Forced ☐ Bending ☐ Centre Not Concentric ☐ Cracks ☐ Crimp/Kink/Ripple/Wave ☐ Cuffs ☐ Crushing ☐ Heat Treat ☐ Wave/Twist in Tube ☐ Marks/Chatter ☐ Temperature/Cure ☐ Set-up ☐ BOM/Route ☐ Broken/Damage/Defect ☐ Inspection Incomplete/Unqualified ☐ Contamination ☐ Countersink ☐ Cut Too Short ☐ Instructions Incomplete/Unclear ☐ Drill Holes ☐ Power Loss/Surge ☐ Folio/Program ☐ Grain ☐ Weld ☐ Wrong Stock Pulled ☐ Out of Sequence ☐ Off-set ☐ Mislabeled ☐ Fit/Function ☐ Misaligned/off center ☐ Positioned Wrong ☐ Outside Dimensions ☐ Over/Under tolerance ☐ Part Incorrect ☐ Part Lost/Missing ☐ Part Moved ☐ Drawing ☐ Finish ☐ Misread ☐ Turning Sequence ☐			
OTHER : ☐					

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Page 3

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Cust Item ID:

Required Date: 3/28/2016 Req'd Qty: 1.00 ***1***

Customer:

Reference:

Approvals: Process Plan: _____ Date: _____ Tooling: _____ Date: _____

Run Start ***NR1***

QC: _____ Date: _____ SPC (Y/N): _____ Date: _____

Stop ***NR2***

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
150		0.00							
150	Large Fab								
Crosstubes	Memo	0.01				BC		16/04/04	
Crosstubes	1-Grind machining marks								
190		0.00							
190	Packaging								
Packaging	Memo	0.00				BC		16/04/04	
Packaging	Identify and stock in kanban rack Location: <u>LG03</u>								
200		0.00							
200	QC21- Final Inspection - Work Order Release								
QC	Memo	0.00							
Quality Control									

ML5 APR 05 2016

ML5 APR 04 2016



Work Order update only

Work Order: _____		DISPOSITION		AGAINST DEPARTMENT/PROCESS					
Part No. _____		Rework ☐		Skid-tube ☐	Cross tube ☐	Water Jet ☐	Engineering ☐		
NCR No. _____		Scrap ☐		Machining ☐	Small Fab ☐	Prod. Eng. Coord. ☐	Quality ☐		
		Use-as-is ☐		Thermoforming ☐	Finishing ☐	Rec/Store/Packaging ☐	Other ☐		
		Suspected Unapproved ☐		Large Fab ☐	Composite ☐	Supplier ☐			
Date :		Step #:		QTY Effective :			MRB (QS1042) Approval		
Description Work Order Deviation				Disposition					
				Completed By					
				Lead hand / Supervisor Approval Verification					
				QC / QA Coordinator Approval					
Root Cause		FAULT CATEGORY							
Environment ☐	No Re-verification ☐	Pressure/Forced ☐	Temperature/Cure ☐	Power Loss/Surge ☐	Positioned Wrong ☐				
Design ☐	Operator ☐	Bending ☐	Set-up ☐	Folio/Program ☐	Outside Dimensions ☐				
Doc/Data ☐	Offset/Setup ☐	Centre Not Concentric ☐	BOM/Route ☐	Grain ☐	Over/Under tolerance ☐				
Equip/Tooling ☐	Supplier ☐	Cracks ☐	Broken/Damage/Defect ☐	Weld ☐	Part Incorrect ☐				
Handling/Pre ☐	Training ☐	Crimp/Kink/Ripple/Wave ☐	Inspection Incomplete/Unqualified ☐	Wrong Stock Pulled ☐	Part Lost/Missing ☐				
Material ☐	Use for Testing ☐	Cuffs ☐	Contamination ☐	Out of Sequence ☐	Part Moved ☐				
Internal Transport ☐	Poor Information ☐	Crushing ☐	Countersink ☐	Off-set ☐	Drawing ☐				
Tribal Knowledge ☐	Rushing ☐	Heat Treat ☐	Cut Too Short ☐	Mislabeled ☐	Finish ☐				
LOA ☐	Product Improvement ☐	Wave/Twist in Tube ☐	Instructions Incomplete/Unclear ☐	Fit/Function ☐	Misread ☐				
Substation ☐	Process Improvement ☐	Marks/Chatter ☐	Drill Holes ☐	Misaligned/off center ☐	Turning Sequence ☐				
Past Expiry Date ☐	Manufacturing Process ☐								
Misidentified ☐	Past Due ☐	OTHER :							

Picklist Print

Page 1

Thursday, March 17, 2016 1:46:18 PM

Work Order ID: 143638

143638

Parent Item: D350-748-143TRN

D350-748-143TRN

Parent Item Name: SS Crosstube Turning Detail

Start Date: 3/17/2016

Required Date: 3/28/2016

Start Qty: 1.00

Required Qty: 1.00

Comments: NEW ISSUE - PRELIM - LL 12.05.08

Component Item ID/ Item Name	Replacement Item ID	Mfg/ Purch	Bin Item	Primary Location	Last Location	Route Seq ID	Unit of Measure	Qty on Hand	Qty per Kit	Total Qty	Qty Issued	Date Issued	Status
D6021-125		Manufactured	No				Each	75.0000		1			

D6021-125

Crosstube Material - 17-4Ph SS

Location	Loc Qty	Loc Code
HALL	55	
127271	35	
85076	20	
LG	20	
127272	20	

1 mm L 16/03/18

DQA: _____ Date: _____



WORK ORDER NON-CONFORMANCE / UPDATE

QA Closed: _____ Date: _____

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Work Order: _____ Part No. _____ NCR No. _____		DISPOSITION Rework ☐ Scrap ☐ Use-as-is ☐ Suspected Unapproved ☐		AGAINST DEPARTMENT/PROCESS Skid-tube ☐ Machining ☐ Thermoforming ☐ Large Fab ☐ Cross tube ☐ Small Fab ☐ Finishing ☐ Composite ☐ Water Jet ☐ Prod. Eng. Coord. ☐ Rec/Store/Packaging ☐ Supplier ☐ Engineering ☐ Quality ☐ Other ☐																																																													
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Misidentified ☐	Past Due ☐																																																																

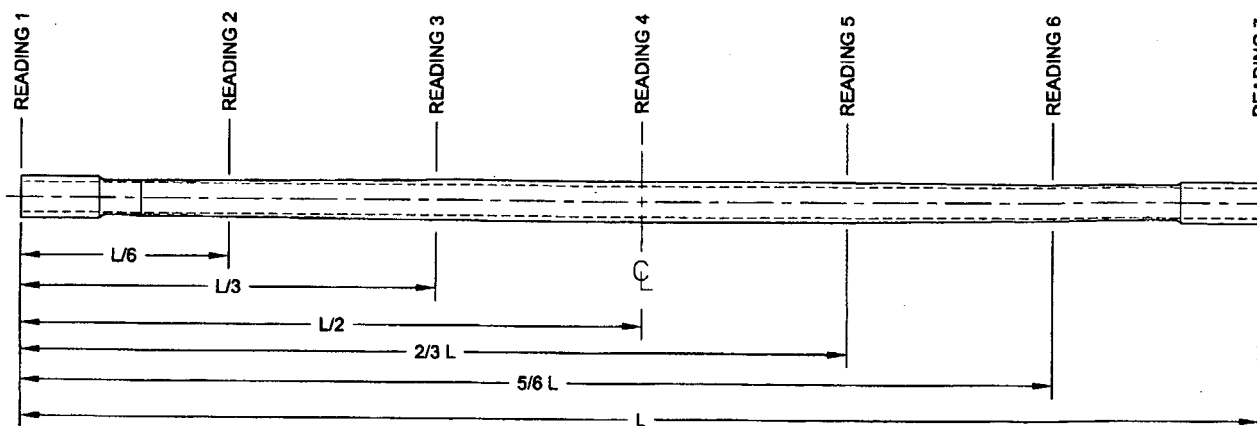
DART AEROSPACE LTD	Work Order: 173 638
Description: Crosstube Assembly (AS350/355 High Fwd SS)	Part Number: D350-748-143
Inspection Dwg: D350-748-143 Rev: A	Page 1 of 2

FIRST ARTICLE INSPECTION CHECKLIST

Inspection Sheet Drawing Dimension	Tolerance	Actual Dimension	Accept	Reject	Method of Inspection	Comments
SIDE A	2.240	+/-0.005	2.245	/		
	2.180	+0.005/-0.000	2.185	/		
	2.180	+0.005/-0.000	2.184	/		
	2.237	+0.005/-0.000	2.242	/		
	2.272	+0.005/-0.000	2.276	/		
	2.306	+0.005/-0.000	2.310	/		
	2.339	+0.007/-0.000	2.343	/		
	2.339	+0.007/-0.000	2.343	/		
	0.062	+/-0.010	.063	/		
	5.25	+/-0.060	5.25	/		
	R0.063	+/-0.010	.063	/		
	R0.50	+/-0.030	.504	/		
SIDE B	2.240	+/-0.005	2.245	/		
	2.180	+0.005/-0.000	2.185	/		
	2.180	+0.005/-0.000	2.184	/		
	2.237	+0.005/-0.000	2.242	/		
	2.272	+0.005/-0.000	2.276	/		
	2.306	+0.005/-0.000	2.310	/		
	2.339	+0.007/-0.000	2.344	/		
	2.339	+0.007/-0.000	2.344	/		
	0.062	+/-0.010	.063	/		
	5.25	+/-0.060	5.25	/		
	R0.063	+/-0.010	.063	/		
	R0.50	+/-0.030	.500	/		
	112.27	+/-0.060	112.27	/		

DART AEROSPACE LTD	Work Order: 143638
Description: Crosstube Assembly (AS350/355 High Fwd SS)	Part Number: D350-748-143
Inspection Dwg: D350-748-143 Rev: A	Page 2 of 2

WALL THICKNESS MEASUREMENT



Location	WALL THICKNESS MEASUREMENT (IN)				Deviation Δw (max-min)	TOLERANCE
	w1	w2	w3	w4		
READING 1 L = 0"	.122	.119	.116	.116	-.006	0.030"
READING 2 L = 19	.136	.121	.112	.123	.024	
READING 3 L = 37	.177	.164	.159	.172	-.018	
READING 4 L = 56	.163	.163	.167	.169	.006	
READING 5 L = 75	.160	.168	.175	.168	-.015	
READING 6 L = 93	.118	.124	.134	.125	.016	
READING 7 L = 112	.117	.115	.119	.122	.007	

Calibration Result

Actual Block Thickness: .100 - .500

Sitemcan 250 Measured Thickness: .100 - .500

DAS
47

Measured by: <i>mmf</i>
Date: 16/03/20

Audited by: 9-89
Date: 16-03-28

Preliminary Approval:
Date:

Rev	Date	Change	Revised by	Approved
A	15.09.09	New Issue (P/O D350-748-103)	KJ <i>[Signature]</i>	<i>[Signature]</i>

Item	Qty	Part Number	Description
	-143		
	X	D350-748-143	CROSSTUBE ASSEMBLY (AS 350/355 HI FWD)
1	1	D6021-125	CROSSTUBE
2	2	D3502-1	SUPPORT
3	2	D5123-7	CLAMP CUSHION
4	1	AETC-1032	INSERT
5	2	MS21920-20 OR MS21920-21-22	CLAMP (PER DART SPEC. M-MS21920-20/-21/-22)
6	1	NAS1149C0363R	WASHER (OR AN960C10)
7	1	NAS1635-3-8	SCREW (OR MS1958-63)
8	A/R	PROSEAL 890 B-2	SEALANT, AMS-S-8802 CLASS B-2

GENERAL NOTES:

- 1) MATERIAL: MANUFACTURED FROM D6021-125 (17-4PH)
FINISHED LENGTH AFTER TURNING = 112.270±0.06 (AFTER BENDING/TRIMMING = 110.27 REF)
- 2) FINISH: PRIME INSIDE AND OUTSIDE PER DART QSI 005 4.2
PAINT OUTSIDE PER DART QSI 005 4.2
- 3) TOLERANCE: PER DART QSI 018 UNLESS OTHERWISE NOTED.
WALL THICKNESS ECCENTRICITY PER DART QSI 038 7.2
MIN. ALLOWABLE WALL IS -0.020 FROM NOMINAL
- 4) UNITS: INCHES UNLESS OTHERWISE NOTED.
- 5) BREAK SHARP EDGES: 0.005 TO 0.010 MAX.
- 6) IDENTIFICATION: DART PART NUMBER "D350-748-143" AND BATCH NUMBER ON INSIDE OF CUFF
PER DART QSI 044 6.4 (VIBRATING STYLUS)
- 7) WEIGHT: 30.45 lbs
- 8) PART IS SYMMETRIC ABOUT CENTERLINE, EXCEPT FOR Ø0.290 HOLE.
- 9) EXTREME CARE MUST BE TAKEN TO PROTECT THE OUTSIDE SURFACE OF THE TUBE. THE OUTSIDE SURFACE MUST BE SMOOTH AND FREE FROM SURFACE DEFECTS SUCH AS SCRATCHES, NICKS, OR DENTS. DEFECTS UP TO 0.005" MAY BE BLENDED OUT LONGITUDINALLY. CIRCUMFERENTIAL GRIND MARKS ARE UNACCEPTABLE. WHEN DRILLING HOLES EXTREME CARE MUST BE TAKEN AND CAREFUL DEBURRING PERFORMED TO ENSURE A CLEAN HOLE WITH NO CRACKING/CHIPPING/GROOVES.

TURNING

- 10) BLEND OUT ALL EDGES FROM MACHINING LONGITUDINALLY, TRANSITION SHOULD BE SMOOTH. NOTE: ALL HOLES ARE DRILLED AFTER BENDING.

BENDING

- 11) BEND PROGRESSIVELY WITH A MINIMUM OF 7 PASSES PER SIDE. MAXIMUM TUBE FLATTENING DUE TO BENDING IS 6% BASED ON O.D. ON TOP HALF OF BEND, AND 8% ON BOTTOM HALF OF BEND.
- 12) MAX AMPLITUDE OF RIPPING ALONG BENT PORTION OF THE TUBE IS 0.030 (ZN A1-3)
- 13) MAX TWIST: WITH XTUBE LAYED FLAT ON SURFACE, THE DIFFERENCE BETWEEN CUFF HEIGHTS FROM THE SURFACE MAY BE NO LARGER THAN 0.38 (ZN C1-3).

ASSEMBLY

- 14) TO INSTALL D3502-1 SUPPORT: ABRASE MATING SURFACE OF SUPPORT AND CROSSTUBE WITH 180-GRIT SANDPAPER AND REMOVE RESIDUE WITH MEK (OR EQUIVALENT). APPLY A 0.02" TO 0.05" THICK LAYER OF PROSEAL 890 CLASS B-2 (OR AMS-S-8802 CLASS B-2) SEALANT TO MATING SURFACE OF SUPPORT.
- 15) TORQUE CLAMPS 60 TO 80 IN.-LB. ENSURE AT LEAST 1.5 THREADS SHOWING IN SAFETY AND THAT NUT HAS NOT BOTTOMED-OUT AFTER TORQUING. PRIOR TO PACKAGING, RE-CHECK TORQUE ON CLAMPS AFTER PROSEAL 890 SEALANT HAS CURED FOR 72 HOURS.

STOP COPY
RETURN TO
ENGINEERING
UNCONTROLLED COPY
SUBJECT TO AMENDMENT
WITH NOTICE
WORK ORDER

143638 MJS
16-03-17

UNDER REVIEW

15/11/24
GRF 18-561 9/12/29

DEO ATTACHED

RELEASED

2015 MAR 18

4PEN 15-547

A	NEW ISSUE	CP	15.01.21
REV.	DESCRIPTION	BY	DATE
DESIGN			
DRAWN			
CHECKED			
MFG. APPR.			
APPROVED			
DE APPR.			
DATE	15.01.21		

DART AEROSPACE LTD
HAWKESBURY, ONTARIO, CANADA

DRAWING NO. D350-748-143
SHEET 1 OF 4

TITLE CROSSTUBE (AS 350/355 HI FWD) NTS

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8 7 6 5 4 3 2 1

D

D

C

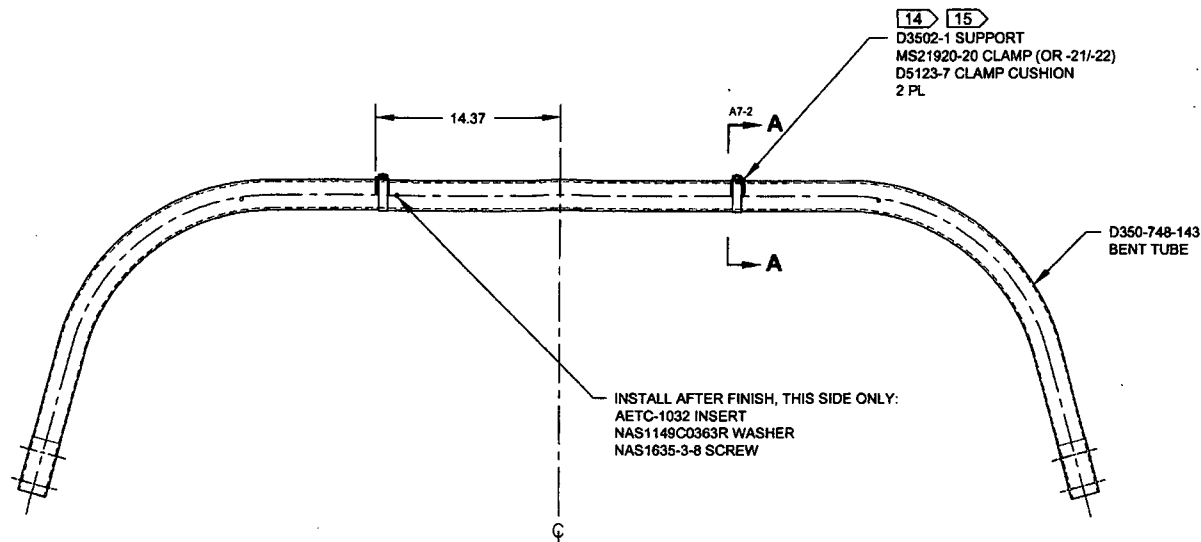
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B

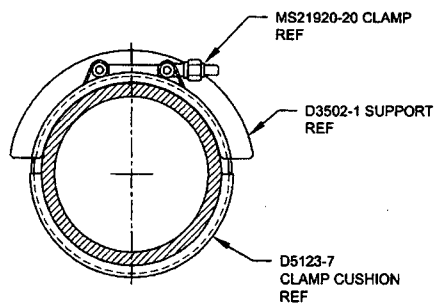
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A

A



**D350-748-143
ASSEMBLY DETAIL**



SECTION A-A D4-2
SCALE 6X

DEO ATTACHED

RELEASED

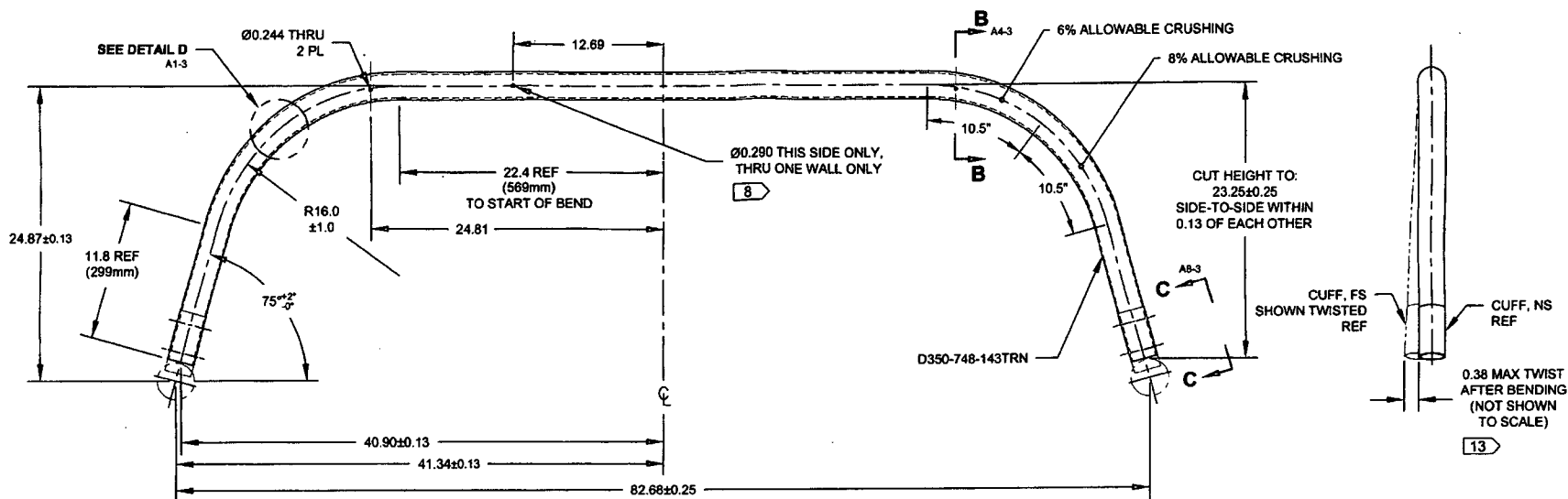
2015 MAR 18
4P EN-15-547

UNDER REVIEW

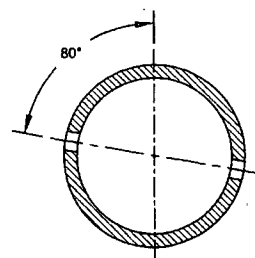
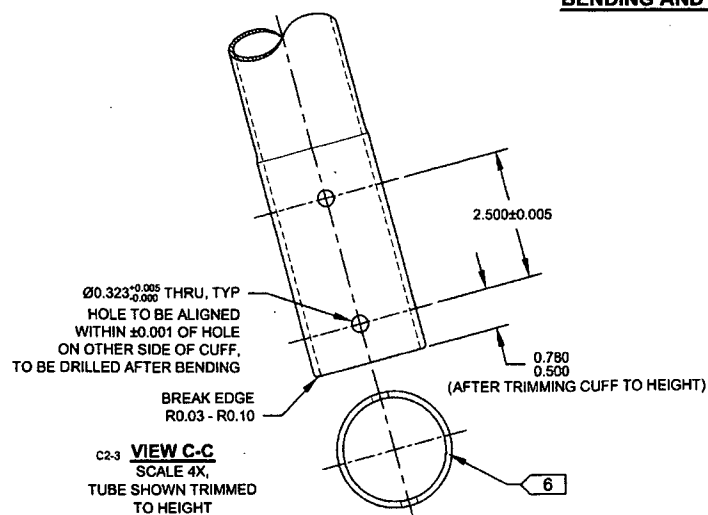
U-15/A/23 dk
9/4/25

DESIGN	9P	DART AEROSPACE LTD	
DRAWN	9P	HAWKESBURY, ONTARIO, CANADA	
CHECKED	A.P.	DRAWING NO.	REV. A
MFG. APPR.	[Signature]	D350-748-143	SHEET 2 OF 4
APPROVED	[Signature]	TITLE	SCALE
DE APPR.	[Signature]	CROSSTUBE (AS 350/355 HI FWD)	NTS
DATE	15.01.21	COPYRIGHT © 2015 BY DART AEROSPACE LTD THIS DOCUMENT IS PRIVATE AND CONFIDENTIAL AND IS SUPPLIED ON THE UNDERSTANDING THAT IT IS NOT TO BE USED FOR ANY PURPOSE OR COPIED OR REPRODUCED IN ANY MANNER WITHOUT WRITTEN PERMISSION FROM DART AEROSPACE LTD.	

8 7 6 5 4 3 2 1



D350-748-143
BENDING AND DRILLING DETAIL 11

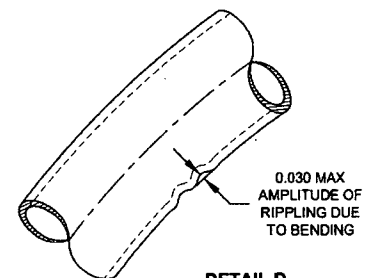


SECTION B-B D3-3
SCALE 6X

RELEASED
2015 MAR 18
DEO ATTACHED

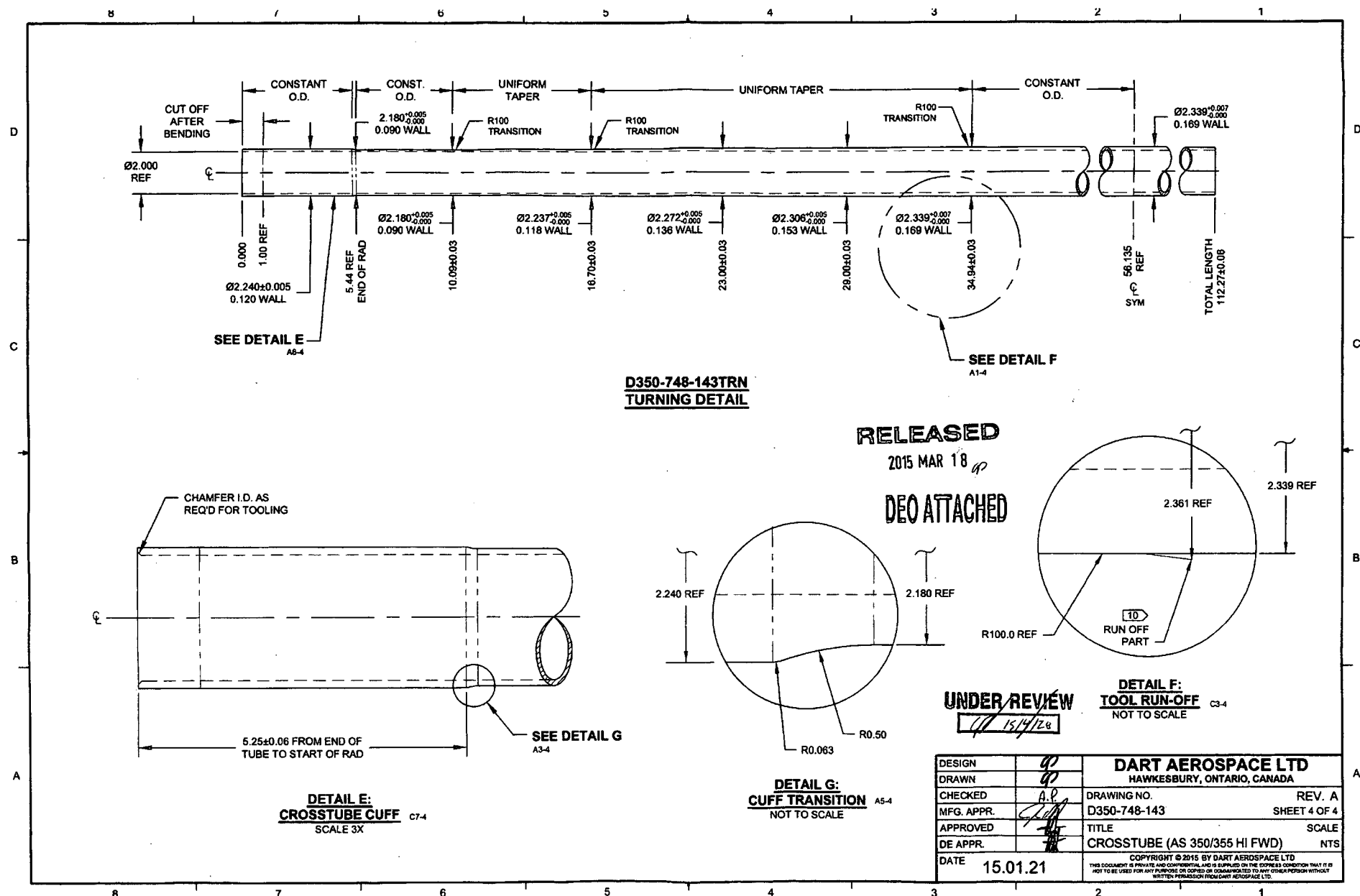
UNDER REVIEW

15/4/28 OK 15/2/29



DETAIL D D7-3
SCALE 4X
RIPPLING EXAGGERATED

DESIGN		DART AEROSPACE LTD	
DRAWN	GP	HAWKESBURY, ONTARIO, CANADA	
CHECKED	A.P.	DRAWING NO. D350-748-143	REV. A SHEET 3 OF 4
MFG. APPR.		TITLE	SCALE
APPROVED		CROSSTUBE (AS 350/355 HI FWD)	NTS
DE APPR.		COPYRIGHT © 2015 BY DART AEROSPACE LTD	
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DRAWING NO. D350-748-143	TITLE CROSSTUBE	REV. A	DART AEROSPACE LTD ENGINEERING ORDER		D.E.O. NO. D350-748-143-A-1	SHEET NO. SHEET 1 OF 1	SCALE NTS
DRAWN <i>qp</i>	CHECKED <i>ASS</i>	MFG. APPR. <i>[Signature]</i>	APPROVED <i>[Signature]</i>		DE APPR. <i>[Signature]</i>		
DATE 15.11.18	DATE 15.11.18	DATE 16.02.19	DATE FEB 19 2016		DATE 2016.02.19		

AMEND NOTE 2 (SHEET 1) AS FOLLOWS:

- 2) FINISH: PREPARE SURFACE PER DART QSI 005 4.1.4
 PRIME INSIDE AND OUTSIDE PER DART QSI 005 4.2
 PAINT OUTSIDE PER DART QSI 005 4.2
 OR
 POWDER COAT WHITE (4.3.5.2) PER DART QSI 005 4.3

RELEASED
 2016-02-26

ECN 16-534

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